National Institute of Environmental Health Sciences

Spatial modelling of the potential temperature-dependent transmission of vector-associated diseases in the face of climate change: Main results and recommendations from a pilot study in Lower Saxony (Germany)

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Year: 2008
Journal: Parasitology Research. 103 (Suppl 1): S55-63

Abstract:

The sustained climate change is going to modify the geographic distribution, the seasonal transmission gate and the intensity of the transmission of vector-borne diseases such as malaria or the bluetongue disease. These diseases occur nowadays at higher latitudes or altitudes. A further rise in ambient temperature and rainfall will extend the duration of the season in which mosquito vectors are transmitting pathogens. The parasites transmitted by the vectors also benefit from increasing temperatures, as both their reproduction and development are then accelerated, too. Thus, it seemed prudent to examine potential effects on the seasonal transmission gate due to the ongoing and predicted climate changes. Lower Saxony (northwest Germany) is a former malaria region with highest incidences of Anopheles atroparvus and tertian malaria along the coastal zones before malaria had finally become extinct in the early 1950s. Nevertheless, the Anopheles mosquitoes which transmit the malaria pathogens have still been present in Lower Saxony up to now. This together with the climate change-related implications gave reason to investigate whether a new autochthonous transmission could take place if the malaria pathogen is introduced again in Lower Saxony. Thus, the potential spatial and temporal structure of temperature-driven malaria transmissions was mapped using the basic reproduction rate (R (0)) and measured and predicted air temperatures (1947-1960, 1961-1990, 1985-2004, 2020, 2060, 2100, each best case and worst case scenario). This paper focuses on both the summarizing of the results from this risk modelling approach and on the conclusions to be drawn. The recommendations highlight the need to link vector monitoring as one of the key elements of an epidemiological monitoring with the environmental monitoring.

Source: http://dx.doi.org/10.1007/s00436-008-1051-z

Resource Description

Climate Scenario :

specification of climate scenario (set of assumptions about future states related to climate)

Special Report on Emissions Scenarios (SRES)

Special Report on Emissions Scenarios (SRES) Scenario: SRES A1, SRES A2, SRES B1, SRES B2

Exposure :

weather or climate related pathway by which climate change affects health

Ecosystem Changes, Temperature

Temperature: Fluctuations

Geographic Feature:

resource focuses on specific type of geography

None or Unspecified

Geographic Location:

resource focuses on specific location

Non-United States

Non-United States: Europe

European Region/Country: European Country

Other European Country : Germany

Health Impact:

specification of health effect or disease related to climate change exposure

Infectious Disease

Infectious Disease: Vectorborne Disease

Vectorborne Disease: Mosquito-borne Disease

Mosquito-borne Disease: Malaria

Mitigation/Adaptation:

mitigation or adaptation strategy is a focus of resource

Adaptation

Model/Methodology:

type of model used or methodology development is a focus of resource

Exposure Change Prediction

Resource Type:

format or standard characteristic of resource

Research Article

Timescale:

time period studied

Long-Term (>50 years)

Vulnerability/Impact Assessment:

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content